

theoretical resolving power in the sixth order is 660,000, and 600,000 has actually been attained on a negative from which was prepared the illustration accompanying the paper.

THE SOLAR PHYSICS OBSERVATORY, CAMBRIDGE.—We have received a copy of the second annual report of the director relating to the year April 1, 1914, to March 31, 1915. Disadvantageous conditions arising out of the war have imposed serious limitations on the output of work, and have also retarded the installation of equipment. Mr. Baxandall has made considerable progress in working out the details of the chemistry stellar spectra for the projected atlas. The green regions of the spectra of α Cygni, α Canis Minoris, α Persei, and α Canis Majoris have been reduced, and the results are being prepared for publication. Spectra of several bright stars have been photographed in the course of adjusting the new spectrograph used with the 15-in. Huggin's refractor. Solar work has evidently been prosecuted both with zeal and success. The observers with the South Kensington spectroheliograph are especially to be congratulated on having secured spectroheliograms of the sun's limb on no fewer than 110 days. The solar eclipse expedition to Theodosia in the Crimea was very unfortunately foiled by clouds, and this is doubly regrettable as the eclipse provided some novel spectroscopic features. Successful photographs of sun-spot spectra have been secured with the McClean solar instruments. In the laboratory a powerful spectrograph of the Littrow type has been improvised, using a 6-in. plane grating and a 6-in. Cooke photovisual lens, and thus the 21-ft. concave grating detained at Odessa will scarcely be missed.

LONG-DISTANCE WIRELESS TELEPHONY.

THE announcement that the United States Navy Department has successfully experimented with a wireless telephone from Arlington, Virginia, to Mare Island, California, is chiefly interesting on account of the distance covered—2500 miles. If this success can be maintained in all conditions it will mark a notable achievement and one upon which the naval authorities in the United States may be complimented, because of the many years of steady and silent work which they have devoted to the subject.

There is nothing inherently impossible in long-distance wireless telephony, and from the scientific point of view there is no reason why it should not be carried on over even greater distances than that recorded above, but there are practical difficulties in regard to the construction of a microphone transmitter capable of passing large high-frequency currents, and in the production of the necessary persistent oscillations. In ordinary telephony, the current going through the microphone is quite small, and so long as the power to be dealt with is small, it is easily possible to obtain a microphone capable of dealing with the amount of energy while giving good articulation. But when a power measured in kilowatts has to be dealt with it is another matter. By using many microphones in parallel; by cooling the carbon granules with gas or immersing them in oil, and a host of similar devices, inventors have sought to produce one capable of dealing for protracted periods with a heavy current; but either they have not been entirely successful in this, or articulation has suffered. It is therefore desirable to await a full official account of the experiments carried out by the United States Navy Department before expressing an opinion upon the results. This is all the more necessary because

of the great difficulty of judging the success of long-distance and other experiments merely by "reading."

It is extraordinary, in practice, to observe the marked difference between the distance at which speech is audible and the distance to which it is truly intelligible. The faint overtones and small nuances upon which intelligible speech depends are, at best, all too lightly impressed on the ever-varying curve of intensity sent out; and if they are smothered up or glossed over by a coarse microphone, a distant receiving station where the signals are weak gets only the bare fundamental tones stripped of all meaning. It is very easy to be deceived in this, and when well-known words are uttered, the ear glibly supplies the missing sounds.

EXPERIMENTS ON HOMING.¹

PROF. J. B. WATSON and Dr. K. S. Lashley have made some important experiments at Bird Key, in the Tortugas, on the homing capacity of the noddy tern (*Anous stolidus*) and the sooty tern (*Sterna fuliginosa*), which breed there in large numbers. The island is peculiarly suitable for the purpose, since it marks the northern limit of the migration of these two tropical terns (so that if the birds are experimentally transported further north they find themselves in regions which they have not previously visited); moreover, on the westward side there is only the open water of the Gulf of Mexico until the shore-line of Texas is reached, Galveston being 855 statute miles distant. "This strip of open water proves a magnificent route for homing experiments." The authors caught terns at their nesting-places, put individual marks of paint on their head and neck, tied a small tag recording the date, locality, and marking round the neck, fixed a larger duplicate tag beside the nest, transported the birds in large cages to a distance, liberated them, and watched for their return. The general result is of great interest:—"The noddy and sooty terns can return from distances up to 1000 miles in the absence of all landmarks, at least so far as the term landmark is understood at present."

Some details of this careful piece of work may be noted, for they are very instructive. From Galveston (855 miles away) three birds returned out of ten, taking from about six to about twelve days; two noddies liberated at 720 miles both returned, taking between eleven and seventeen days; out of ten birds liberated at 585 miles eight returned, taking from about four to about eight days; out of four noddies and four sooties liberated in open water 461 statute miles away, two noddies returned in three days; of twelve taken north to Mobile, only one returned, taking about seven days; two noddies and two sooties carried in a state-room to Havana and released in the harbour there early in the morning of July 11, returned to Bird Key on the 12th, the distance in a straight line being about 108 statute miles; of three noddies and two sooties liberated off Cape Hatteras (850 miles to the north), both of the latter and at least one of the former species returned after several days. "The alongshore route, which is the one in all probability chosen by the birds on their return, since they were gone several nights, is approximately 1081 statute miles." (It seems that the birds almost never rest on the water, unless they happen to find pieces of driftwood or the like.) The records show that the terns often take as long for short distances as for long distances, and that a return from the open sea outside of all landmarks is just as practicable as a return from a coast.

By a series of exceedingly careful experiments Dr.

¹ Papers from the Department of Marine Biology of the Carnegie Institution at Washington. Vol. vii., "Homing and Related Activities of Birds." By J. B. Watson and K. S. Lashley. Pp. 1-104+7 plates+9 figs. (Washington: The Carnegie Institution, 1915.)

Lashley has shown that the problems of proximate orientation are relatively simple and straightforward. On the island of Bird Key the terns make their adjustment to the nest, mate, young, etc., on a basis largely of visual habits. Kinæsthetic habits are also involved, but to a less extent. On dark nights the sooty tern hovers over the crowded nesting area, giving out his call; he is answered by his mate and young, and is thus guided to the nest. Dr. Lashley found no evidence of any remarkable or unusual sensitiveness, or of the functioning of any hypothetical sense-organ.

As to the more difficult problem of distant orientation, the authors consider and dismiss various suggestions: that the birds follow water-currents; that they get their bearings by ascending to a great height; that they have special visual acuteness, e.g. to infra-luminous rays; or that they have special tactual or olfactory sensitiveness in the nasal cavities. The experimental thoroughness with which the spectral sensitivity and the functioning of the nasal chamber are dealt with is worthy of imitation. The authors are unwilling to suggest at present the assumption of any new and mysterious sense; they rightly prefer to continue to experiment. They suggest various experiments, e.g. on the sensory equipment of homing pigeons, and they conclude:—"We are far from being without hope that future studies may yield results which will enable us to solve the riddle which has been propounded to scientific men of all ages, but as yet never satisfactorily answered."

THE INSTITUTE OF METALS.

AT the meeting of the Institute of Metals held in London on September 17, a number of interesting papers were read and discussed. Amongst these were the following:—"Specifications for Alloys for High-speed Superheated Steam Turbine Blading," by W. B. Parker. In this paper the author confines his attention to a consideration of the non-ferrous alloys which are used for turbine blading. He gives a clear description of the physical and chemical properties which are essential for this purpose, and discusses in detail the causes of the wearing and corrosion of the blades. It is pointed out that although non-ferrous alloys have the advantage of being non-rusting, they do not possess a good proportional limit which is capable of being retained for long periods when exposed at the temperature of highly superheated steam. This fact has so far prevented the use of non-ferrous alloys for this particular purpose, and steel alloys are invariably utilised. The proportional limit should remain, for temperatures between 100° and 450° C., within 10 per cent. of its value at the ordinary temperature. Investigation is, therefore, needed, in order to find either (1) a non-ferrous alloy which will almost indefinitely retain its hardness up to a temperature of 450° C., or (2) a steel which will fulfil the above requirements and also be non-rusting. Anyone conducting research along these lines will find Mr. Parker's paper extremely valuable.

"The Constitution of Brasses Containing Small Percentages of Tin," by Dr. Hudson and R. M. Jones. This paper deals with the constitution of the ternary alloys containing from 50 to 70 per cent. of copper and 0.5 per cent. of tin. The ranges in which the various constituents can exist, at temperatures below the lowest thermal critical points of the alloys, have been determined, and the results are embodied in a constitution diagram. Most of the alloys fall into one of the two following groups: (1) Those in which the tin is held in solid solution, and conse-

quently possess the normal structure of the copper-zinc series, and (2) those in which a constituent is present, which is similar to the δ of the copper-tin alloys.

"A Thermostat for Moderate and High Temperatures." The authors of this paper, J. L. Haughton and D. Hanson, describe a simple and much-needed apparatus which they have designed for keeping constant temperatures for long periods. The records illustrated in the paper show that the apparatus is highly satisfactory. By using fused silica in the place of glass it is hoped that the effective range of temperature will be considerably extended.

"Metallic Crystal Twinning by Direct Mechanical Strain." In this paper Prof. C. A. Edwards gives evidence which proves that certain metallic crystals are twinned when subjected to mechanical deformation without the intermediate operation of annealing. In the case of tin the twinning is very marked, even at the temperature of liquid air. Diagrams are shown to illustrate the possible mechanism of twinning, and from a consideration of these it is concluded that amorphous layers are produced on the twinning planes.

"The Micro-chemistry of Corrosion," by Dr. Desch and H. Hyman. The corrosion of gun-metals has been examined by the electrolytic method. The presence of tin decreases the rate of corrosion by forming a layer of basic salts which act as a protective coating on the metallic surface. Coarsening the structure by annealing increases the corrosion. A pure alpha alloy is more readily acted upon than one which contains the eutectoid, but the presence of the beta, obtained by quenching, has very little effect.

ON THE FUNCTIONS OF THE CEREBRUM.¹

THE first of these papers is a study of thirty-eight cases of insanity (dementia præcox, general paralysis, arteriosclerotic dementia, and senile dementia) and their autopsies. It is pointed out that entirely different symptoms (hallucinations, delusions, loss of memory, disordered conduct) may occur in different patients, although the associated cortical atrophy may occur in precisely the same areas; also that the same symptoms may occur in different patients in whom the cortical atrophy is subsequently found to be in different areas. The author, however, ignores the fact that different layers of the cerebral cortex are affected in the different diseases.

The second paper is the result of an experimental study of cerebral localisation in monkeys. It is there pointed out that any given cortical motor centre (the leg area, for example) differs in size and shape in different animals of the same species, in the two hemispheres of the same animal, and even in the same hemisphere at different times. For instance, it is found that the arm can sometimes be stimulated from a spot in the middle of the leg area, sometimes not. From these data Dr. Franz draws conclusions as to certain possible connections between neurons. We are quite prepared to go even as far as this with him; but when he offers these neural arrangements as an explanation of "the variations of behaviour of different animals and of the same animal at different times to the same form of stimulation," we must join issue. Not so much that Dr. Franz's suggestions are incorrect from a neurological point of view

¹ (1) "Symptomatology Differences Associated with Similar Cerebral Lesions in the Insane." (2) "Variations in Distribution of the Motor Centres." By Shepherd Ivory Franz. (Princeton, N.J.: Psychological Review Co.)